Laparoscopic Nephrectomy for Pyonephrosis During Pregnancy: Case Report and Review of the Literature

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The maternal and fetal complications of pyonephrosis during pregnancy can be devastating, thus the call for urgent but safe intervention. Laparoscopic nephrectomy has been used safely and effectively in nonpregnant patients with pyonephrotic kidney. We report on a case of a 28-year-old pregnant woman with pyonephrotic kidney that we believe to be the first such case managed by transperitoneal laparoscopic nephrectomy. A review of the reported cases of laparoscopic nephrectomy for different indications and by different approaches during pregnancy is also presented.
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Pyonephrosis is a serious condition during pregnancy. It requires urgent but safe drainage of pus and interval nephrectomy after delivery. Percutaneous nephrostomy (PCN) is used for this purpose. However, physiologic changes occurring during pregnancy make the drainage of pyonephrosis by PCN tube difficult due to the high rates of encrustation in pregnant patients.[1] Thus, PCN in the setting of pyonephrosis during pregnancy is complicated by frequent reinsertions and increased infection rates, which may have dangerous effects on maternal and fetal health. Moreover, a tube that is draining pus, hanging by the side of the body of a pregnant woman, adds a psychological component to the physical morbidity. Therefore, nephrectomy seems to be the best option in the setting of

suboptimal drainage of pyonephrosis by PCN during pregnancy.

At present, the experience of laparoscopic nephrectomy during pregnancy is frightening to the patient. When embarking on laparoscopic nephrectomy in a gravid patient, the physician must consider the advantages and disadvantages of the procedure. We report on the first transperitoneal laparoscopic nephrectomy during pregnancy, and discuss the key points involved in laparoscopic surgery during pregnancy. In addition, we also present a review of the reported cases of laparoscopic nephrectomy during pregnancy.

Case Report

A 28-year-old woman in her fourth week of pregnancy presented with high-grade fever and right loin pain. Her total leukocyte count was 20,200/mm^3. Ultrasonography (USG) showed right pyonephrosis and normal left kidney. Two years previously, the patient had presented at our center with fever and sepsis. At that time, her urine examination showed innumerable pus cells. USG revealed right upper ureteric calculus and infected hydronephrosis with thin renal parenchyma. PCN was performed and the infection subsided. PCN was draining 800 to 900 mL urine per day. Renal scintigraphy revealed borderline right renal function. Based on the findings of renal scan and USG, the decision was made to remove the right kidney, but the patient did not consent. Therefore, right laparoscopic ureterolithotomy was then performed.

On this occasion, PCN was performed to drain the pyonephrotic kidney. The PCN tube was continuing to drain pus for a long period of time. In view of her condition, she was given the option of either medical termination of pregnancy or to continue the pregnancy with prolonged PCN until delivery. As this was her first pregnancy, she opted to continue the pregnancy with PCN. Therefore, we started to manage her with PCN although it became blocked every 7 to 10 days. It had to be changed thrice and flushed 4 times during the next 6 weeks. On most occasions, she needed admission and antibiotics. At 10 weeks' gestation she presented again with a blocked PCN, fever, and loin pain. USG confirmed a viable first trimester pregnancy. After we explained the harmful effects of sepsis to the patient and the fetus, she was advised about laparoscopic nephrectomy. The procedure and its potential hazards to the fetus were fully explained to the patient, as well as the possibility of open conversion. The patient finally gave consent. In view of the relative safety of laparoscopy within the second trimester, she gradually transitioned to her second trimester with low-dose antibiotics and close follow-up. The procedure was planned at 14 weeks' gestation.

Right laparoscopic nephrectomy was performed by transperitoneal approach without complications. The patient was placed in the lateral position. As suggested by the obstetrician, infusion of isoxsuprine was initiated preoperatively and continued until the end of the procedure. A 12-mm camera port was placed by open technique about 3 fingers toward the right side at the level of the umbilicus. Two other ports were also placed, a 10-mm port 2 fingers below the right subcostal margin at a level between the xiphoid and the umbilicus, and a 5-mm port midway between the umbilicus and the anterior-superior iliac spine. As the patient had a large abdomen, all ports were inserted 2 to 3 fingers lateral to previously inserted port sites. The insufflation pressure was kept at 10 mm Hg. Standard laparoscopic nephrectomy was successfully completed. The specimen was removed by lateral enlargement of the lower port incision and the patient remained stable throughout the procedure, which was 188 minutes in duration including the anesthesia time. Fetal cardiac activity was monitored throughout the procedure and patient and fetal stability were ascertained at the end of the procedure. Postoperatively, she was given a maintenance dose of isoxsuprine for 3 days and fetal cardiac activity was monitored at regular intervals. She was discharged on the fifth postoperative day (Figure 1). The remainder of the pregnancy was uncomplicated. She had a normal vaginal delivery at term, giving birth to a healthy female child weighing 2850 g.

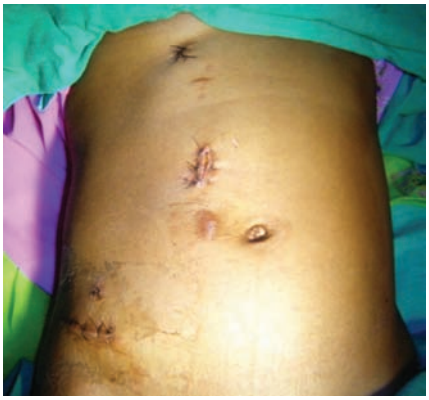

Figure 1. *Photograph of the patient on the fifth postoperative day. Scars of previous surgery (right laparoscopic ureterolithotomy) can also be seen.*

Discussion

When pyonephrosis complicates pregnancy, maternal ill health makes

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management difficult, and necessitates careful consideration of risks of both the disease and the intervention to mother and fetus. Cystoscopy and retrograde stent insertion can be performed under local anesthesia, but are associated with a small miscarriage rate.[2] USG-guided PCN can be safely performed during pregnancy to maintain the drainage of pyonephrosis until delivery[3]; it may not be effective in all cases.[4] Dovlatian and colleagues[4] reviewed the records of 120 pregnant women with pyodestructive forms of pyelonephritis. Eighty-three women underwent PCN that was ineffective in 12 patients (14.5%) who ultimately required nephrectomy,[4] which is the best option in total destruction of the kidneys.[3] Furthermore, when inserted during early pregnancy, PCN has increased chances of either falling out or becoming calcareous, which will necessitate multiple repeat nephrostomies throughout the pregnancy[2] as in our case, thus increasing morbidity.

Our patient was initially managed with prolonged PCN but it was not effective and got blocked very frequently, leading to morbidity and sepsis. The decision to operate on the patient and remove the kidney was difficult and was based on consideration of wishes and concerns of the mother and her family members, as well as the advantages and disadvantages of laparoscopic nephrectomy at this stage.

Until recently, abdominal emergencies have been managed by open procedures. With increasing experience as well as technical advances in laparoscopic surgery, many surgeries are being performed in a minimally invasive fashion,[5] even in pregnant patients.[6] This is further supported by the fact that laparoscopy has the same indications in pregnant and nonpregnant patients for the workup and treatment of acute abdominal conditions.[6] Apart from the well-documented advantages of laparoscopic surgery over open surgery shared by pregnant and nonpregnant patients, additional benefits in pregnant patients include less respiratory depression because of reduced postoperative narcotics requirements, the lower risk of wound complications such as incisional hernia, decreased risks of thromboembolic events due to early mobilization, and diminished postoperative maternal hypoventilation.[7] Moreover, with improved visualization, laparoscopy reduces the risk of uterine irritability by decreasing the need for uterine manipulation and thus results in lower rates of spontaneous abortion and preterm delivery than open surgery.[6]

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Certain limitations of laparoscopy during pregnancy have been highlighted, including fetal acidosis secondary to CO_2 absorption, decreased uterine blood flow and alteration in placental perfusion secondary to pneumoperitoneum, fetal hypotension resulting from low maternal cardiac output, and injury to the gravid uterus.[6-8] In the absence of definitive evidence (Level I/Grade A evidence) to date, many surgeons believe that pregnancy may be a contraindication to laparoscopy.[5] However, experience with cholecystectomy, appendectomy (Level II/Grade B evidence), and adrenalectomy (Level III/Grade C evidence) suggests that such laparoscopic nonobstetric surgeries in pregnant patients can be safely done when standard precautions are taken.[6,9-11] In a study by Reedy and colleagues,[12] no differences were seen in fetal malformations or survival after laparoscopic (n = 2181) or open (n = 1522) abdominal nonobstetric surgeries during pregnancy. In another study, Holthausen and associates[13] reviewed 112 laparoscopic nonobstetric procedures during pregnancy, and found that the outcome of the mother and the baby delivered was excellent.

At present, the experience of pure laparoscopic nephrectomy during pregnancy comprises only six cases performed to date (Table 1). Indication for operation was renal cell carcinoma (RCC) in five cases.[5,14-17] In one case, retroperitoneoscopic nephrectomy was performed for giant hydronephrosis in a patient at 9 weeks of gestation.[2] Recently, a case of successful robot-assisted laparoscopic partial nephrectomy for RCC has been reported from South Korea (Table 1).[18] Our case is the first case of pure transperitoneal laparoscopic nephrectomy performed for pyonephrotic nonfunctioning kidney during pregnancy.

Six of these reported procedures were performed during the second trimester and the remaining two during the first trimester. Traditionally, it had been recommended that the best time to operate was the second trimester as this minimized the intervention-related spontaneous abortion rate during the first trimester, and avoided the danger of preterm labor associated with surgical intervention in the third trimester.[10] This historical recommendation has been refuted by several recent reports, including the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) 2008 report that recommended that laparoscopic

Table 1
Reported Cases of Laparoscopic Nephrectomy During Pregnancy

	O'Connor JP et al[5]	Sainsbury DC et al[14]	van Basten JP et al[15]	Stroup SP et al[16]	Mastoroudes H et al[2]	Lee D et al[17]	Park SY et al[18]
Year	2004	2004	2006	2007	2007	2008	2008
Age (y)	34	30	30	52	32	39	36
Diagnosis	RCC	RCC	RCC	RCC	Giant hydro-nephrosis	RCC	RCC
Weeks of gestation at surgery	19	11	16	25	9	19	14
Approach	Transperitoneal	Transperitoneal	Retroperitoneal	Retroperitoneal	Retroperitoneal	Transperitoneal	Transperitoneal RLPN
Procedure time (min)	210	90	135	240	180	160	165
Outcome of the procedure	Procedure well tolerated	Uneventful	Uneventful	Uneventful	Uneventful	Procedure well tolerated	Uneventful
Gestational age at delivery	38	At term	40	33	At term	39	–
Apgar score (at 1 min/5 min)	8/9	Unknown (healthy baby)	Unknown (healthy, mature baby)	A = 8/9, B = 8/8 (twin pregnancy)	Unknown	Unknown (normal baby)	Unknown
Birth weight of baby (g)	2950	3930	2930	A = 1919, B = 2185	3200	Unknown	Unknown
Follow-up of the baby	Growing well, normal milestones	Unknown	Unknown	A: Normal development & milestones, B: Died due to complications of holoprosencephaly y at 60 days	Unknown	Normal development	Unknown

RCC, renal cell carcinoma; RLPN, robot-assisted laparoscopic partial nephrectomy.

intervention can be performed in any trimester without any increased risk to the mother or fetus, if warranted by the patient's condition.[6]

The issue of transperitoneal and retroperitoneal approach to laparoscopic nephrectomy in pregnancy is still open for discussion. The transperitoneal route provides a larger working space, which is more desirable for pregnant patients.[5] The retroperitoneal approach, on the other hand, provides early control of renal vessels and allows extraperitoneal dissection without bowel manipulation and, in pregnant patients, minimizes the uterine irritation and thus the risk of preterm labor.[5,16] As a result of our limited experience with the retroperitoneal approach, we preferred the transperitoneal route. Our operative time of 188 minutes was within the range of reported cases.

Among the reported cases of laparoscopic nephrectomy in pregnancy, all had an uneventful outcome. Most (7/8) deliveries happened at term with healthy babies.

Current literature provides important recommendations for safe laparoscopy during pregnancy. CO_2 insufflation pressure should be kept between 10 to 15 mm Hg and intraoperative CO_2 monitoring by capnography should be used during laparoscopy in the pregnant patient.[6,16] Intraoperative and postoperative prophylaxis for deep venous thrombosis and early postoperative ambulation are recommended in pregnant patients. Fetal heart monitoring should be done pre- and postoperatively.[6] According to the latest SAGES guidelines, tocolytics should not be used prophylactically, but should be considered perioperatively in coordination with obstetric consultation when signs of preterm labor are present.[6]

Apart from laparoscopic appendicectomy and cholecystectomy, few successful laparoscopic adrenalectomies have been performed in gravid patients.[11] In addition, some studies have shown equivalence between laparotomy and laparoscopy in pregnancy.[12,13,19] However, a prospective study on the safety and effectiveness of laparoscopy during pregnancy, or for that matter, laparoscopic nephrectomy for pyonephrosis and nonfunctioning kidney is neither available at present nor likely to be performed in the near future.

Conclusions

Pyonephrosis in pregnancy needs urgent but safe intervention. The successful outcome of our case supports the view that transperitoneal laparoscopic nephrectomy is feasible and safe if standard precautions are exercised. In view of the fact that there are no definitive prospective data available on this issue and that certain questions are still open for debate, we recommend close cooperation among urologist, anesthetist, and obstetrician, as well as open discussion with the patient and the family regarding the advantages and disadvantages of such intervention in pregnancy. ■

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Main Points

- When pyonephrosis complicates pregnancy, maternal ill health makes management difficult, and necessitates careful consideration of the disease risks and the intervention to both mother and fetus.
- Benefits of laparoscopic surgery in pregnant patients include less respiratory depression because of reduced post-op narcotics requirements, lower risk of wound complications, decreased risks of thromboembolic events due to early mobilization, as well as diminished post-op maternal hypoventilation.
- Limitations of laparoscopy during pregnancy include fetal acidosis secondary to CO_2 absorption, decreased uterine blood flow and alteration in placental perfusion secondary to pneumoperitoneum, fetal hypotension resulting from low maternal cardiac output, and injury to the gravid uterus.
- The issue of transperitoneal and retroperitoneal approach to laparoscopic nephrectomy in pregnancy is still open for discussion. The transperitoneal route provides a larger working space, which is more desirable in pregnant patients and is feasible and safe if standard precautions are exercised.
- Close cooperation is recommended among urologist, anesthetist, and obstetrician, as well as open discussion with the patient and the family regarding the advantages and disadvantages in dealing with pyonephrosis in pregnancy.

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